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Biology Module 5

Heredity WORKSHEETS

Worksheet 1 General Adaptations for Reproduction

Fill in the blank spaces.

Student Name.....

Asexual reproduction involves a)..... parent(s). The offspring are genetically b)..... to their c)..... and to each other. They are a d)..... The advantage of asexual reproduction is that it allows e)..... ..... to take advantage of good conditions. The disadvantage is lack of f)....., which helps a species survive when g).....

All forms of asexual reproduction involve the cell division called h).....

Sexual reproduction involves the cell division i)..... to produce the reproductive cells or j)..... Each gamete is genetically k)..... and the number of l)..... has been halved, so that the correct number is restored when m)..... occurs.

In n)..... environments, fertilisation often occurs outside the organisms body. This is called o)..... fertilisation.
In terrestrial environments, most organisms have evolved to use p)..... fertilisation.

Land plants have adapted to have the male gamete, called q)....., enclosed in a capsule. This can be transported by the r)..... or carried by various animals. Once it reaches a receptive flower, the "sperm" cell is released to swim along the s)..... tube to the t)..... of the flower where the eggs are.

In animals, the female reproductive system is kept u)..... so that sperm can swim to the eggs. In most cases of internal fertilisation, v)..... (more/less) eggs are produced compared to external fertilisation.

Worksheet 2 Test-Style Questions section 1

Student Name.....

Multiple Choice

1.
Which statement about mitosis is INCORRECT?
A. the chromosome number is halved.
B. the daughter cells are genetically identical
C. is the basis for all asexual reproduction.
D. produces 2 daughter cells from a single division.

2.
A "pollen grain" can be thought of as:
A. an egg in a shell.
B. a plant seed.
C. a sperm cell in a waterproof capsule.
D. an asexual spore

3.
Internal fertilisation, when compared to external fertilisation, usually:
A. involves fewer eggs being produced.
B. is less likely to be successful.
C. wastes a lot of gametes.
D. occurs in the aquatic environment.

Longer Response Questions

Answer on own paper if insufficient space.

4.
Distinguish between the processes of Mitosis and Meiosis in terms of the daughter cells produced.

5.
a) Compare and contrast internal and external fertilisation.

b) Discuss how these reproductive strategies relate to habitat.

6.
a) Describe the conditions under which asexual reproduction is advantageous.

b) What is the advantage of sexual reproduction?

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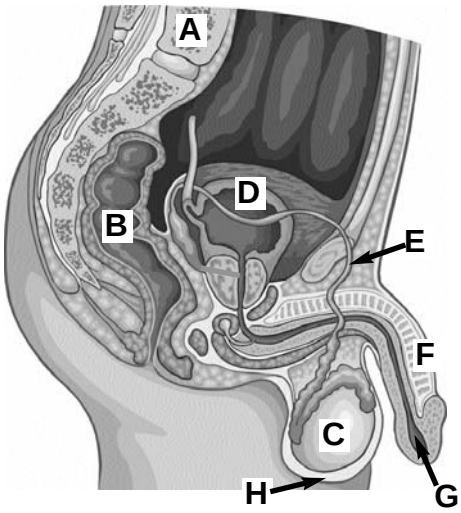
Worksheet 3 Male Reproductive System

Student Name.....

1. Fill in the blank spaces.
Male reproductive cells are called a)..... cells. They are produced in the b)..... by the cell division c)..... The testes hang outside the body in the d).....

Sperm cells move through the e)..... ..... to join the urethra. Various glands add fluids to keep the sperm healthy. This fluid containing sperm is called f).....

The penis is filled with g)..... tissue which can fill with h)..... to make the i)..... hard. During sexual intercourse, j)..... is ejaculated from the urethra into the female k)..... Sperm cells then swim to find & l)..... the egg.



2. Identify the structures A,B,C, etc. in the diagram

A = ... B = ... C = ... D = ...

E = ... F = ... G = ... H = ...

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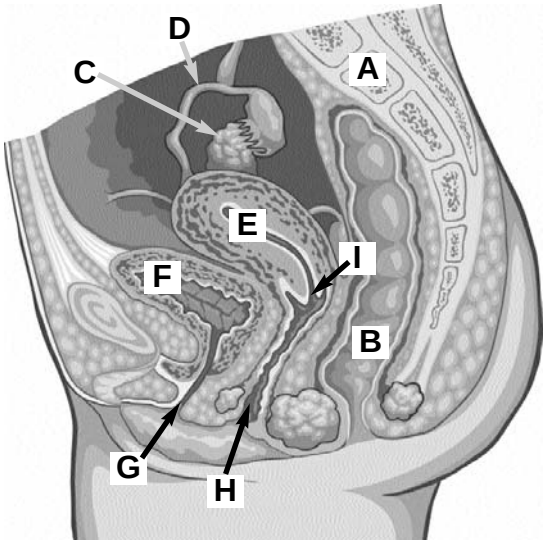
Worksheet 4 Female Reproductive System

Student Name.....

1. Fill in the blank spaces.
In females, a)..... (cell division) occurs in the b)..... before a girl is born. After puberty, the eggs mature (usually) 1 per month.

The mature egg is released from an ovary into the c)..... While travelling through this tube the egg can be d)..... by a male e)..... cell.

The fertilised egg, or "f)....." begins dividing by g)..... (cell division) to form an h)..... The embryo implants into the wall of the i)..... and draws nourishment from the blood-rich tissue. Gradually, a structure called the j)..... grows. This allows exchange of k)....., ... and wastes from mother to foetus. The foetus develops surrounded by a membrane (the "l)....."") filled with fluid to cushion the baby.



2. Identify the structures A,B,C, etc. in the diagram

A = ... B = ... C = ... D = ...

E = ... F = ... G = ... H = ...

I = ...

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Worksheet 5 Hormones & Reproduction

Student Name.....

Fill in the blank spaces.

Puberty

The male hormone a)..... causes development of the "secondary sex characteristics" such as b)..... voice and c)..... hair.

In females the hormone d)..... causes development of the e)..... and changes to hip structure to allow for f).....

Menstrual Cycle

Hormones from the g)..... gland increase levels of oestrogen and cause an egg to mature in a "bubble" called a h)..... This bursts and releases the egg.

The remnant follicle releases a hormone i)....., which causes the wall of the j)..... to prepare for a pregnancy. If this does not occur, hormone changes allow the wall to slough away as menstrual bleeding.

Pregnancy & Birth

If pregnancy does occur, high levels of k)..... hormone continue. This suppresses l)..... (egg production) and maintains the uterus and placenta. The birth process is set off by a hormone from the m)..... gland. This causes the n)..... to dilate, and produces o)..... of muscles to expel foetus and placenta.

Worksheet 6 Genetic Manipulation of Plants & Animals

Guided Notes. (Make your own summary)

1.

a) What is "selective breeding"?

b) When did humans begin doing it?

c) What is its purpose?

d) Give examples of its effect(s) on a named species.

2.

a) What is a clone?

b) What is the simplest way to produce a plant clone?

c) Who was "Dolly" the sheep?
Research: why was she called "Dolly"?

3.

Outline the process of tissue culture.

4.

What are some of the puposes of cloning plants or animals?

5.

a) What is the effect of selective breeding and cloning (plus artificial insemination in animals) on the genetic diversity of the species involved?

b) What is the danger in this?

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Worksheet 7 Comparing Processes

Student Name.....

Complete each table of comparison

Table 1	Asexual Reproduction	Sexual Reproduction
No. of Parents	a)	b)
Type of Cell Div. involved	c)	d)
Are offspring same as each other? (genetically)	e)	f)
Are offspring same as parent(s)? (genetically)	g)	h)

Table 2	Mitosis	Meiosis
No. of cells produced	a)	b)
No. of chromosomes in new cells (compared to original)	c)	d)
Are new cells the same as each other? (genetically)	e)	f)
Are new cells the same as parent cell? (genetically)	g)	h)
Type of Reproduction	i)	j)

Worksheet 8 Chromosomes & DNA

Student Name.....

Fill in the blank spaces.

Chromosomes are thread-like structures in the a)..... of a cell. They are only visible during b).....

Chromosomes come in pairs, referred to as c)..... The members of a c)..... pair are not identical, but correspond with each other because they carry d)..... genes in corresponding locations. Before a cell division, each chromosome is e)..... to make a "double chromosome". The 2 parts are called f)..... and they are g)..... to each other.

In Mitosis, the chromosomes line up h)..... and the i)..... separate, so that the daughter cells are j)..... to each other, and to the k)..... cell.

In Meiosis, the chromosomes line up l)..... and the first division separates the m)..... pairs. Then the cells divide again to form n)..... (number) gametes, each with o)..... the original number of chromosomes.

Body cells with pairs of chromosomes are called p)..... while gametes are said to be q)..... Human body cells have a total of r)..... (number) chromosomes, while egg or sperm cells have s)..... (number)

Chromosomes have been analysed chemically and found to contain t)..... and ..... It is known that the DNA molecules contain a chemical code which specifies a u)..... Thus, each chromosome contains many genes, each one encoded by a molecule of v).....

The DNA molecule is a w)..... of repeating units called x)..... Each one is made of 3 smaller parts; y)..... and ..... and a "....."

There are 4 different "bases", known by the intial letters of their names; z)....., ..., ... and ..... (letters) The DNA molecule is a double- aa)..... shape, made of ab).....(number) strands resembling a twisted ladder.

The "rungs" of the ladder are formed by 2 "bases" bonding with each other. The bases can only bond in combinations ac)..... and .....

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Worksheet 9 DNA & Polypeptide Synthesis

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Student Name.....

Fill in the blank spaces

The discovery of the structure of DNA shows how good a)..... and b)..... contribute to scientific progress. Maurice c)..... was able to prepare a crystal of pure DNA, and Rosalind d)..... was able to get an X-ray Diffraction image of the crystal, but neither of them could interpret it. James e)..... collaborated with them, and took their data to Francis f)..... who had become an expert in this new technology. Between them, Watson & Crick figured out the double-helix shape and the g).....-pairing structure of DNA.

The h).....-stranded structure, and the complementary base-pairing allows DNA molecules to be i)..... in preparation for a cell j)..... First, the DNA strands k)..... Then each strand can act as a l)..... for the making of a new complementary strand.

Each base specifies what must go on the new strand, because only bases m)..... & ..... and bases n)..... & ..... can go together. Once a new strand is built onto each "old" strand, the result is 2 o)..... DNA molecules.

Proteins are polymers of p)..... ..... A chain of p)..... is called a "q)..... chain". To become a functioning protein, it must twist and fold into a precise r)..... Exactly how the chain twists and folds depends on the exact s)..... of the amino acids. There are about t)..... (number) different amino acids and they may attract or u)..... each other, causing the chain to twist and fold upon itself.

Some different types of proteins include v)..... which catalyse metabolic reactions, and w)..... proteins in muscles, skin and hair cells. In each case, it is the x)..... of the protein which is vital to its correct functioning. This shape is due to the sequence of y)..... acids, and these are specified by the base sequence of the z).....

In DNA each aa)..... (number) bases form a code word (called a ab).....) to specify one amino acid. The first step in the process is called ac)..... and involves the production of a molecule of ad)..... To do this, the "gene strand" of the DNA is used as a ae)..... to build the m-RNA from nucleotides. Compared to DNA, the m-RNA is only af).....-stranded, and has a different ag)..... in the "backbone" of the molecule, and one different ah).....

Next, the m-RNA moves out of the ai)..... to one of the aj)..... These organelles are the sites of protein ak)..... Here the second stage, called al)....., occurs.

According to the code of bases on the m-RNA, amino acids are placed one-by-one in sequence to build the am)..... chain. Another form of RNA, called an)..... carries each amino acid into place. The enzymes of the ao)..... then catalyse the reaction to join the amino acids to each other.

To cause a phenotype to occur, the polypeptide chain must then twist and fold to form a functioning ap)..... As an example, it could become an enzyme, which aq)..... a chemical reaction in the iris of the eye. The reaction might result in the production of a coloured ar)..... which produces the phenotype of eye colour.

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Worksheet 10 Mendelian Genetics Questions

Student Name.....

1.
Explain the difference between each pair of words:
a) Dominant & Recessive genes.

b) Homozygous & Heterozygous.

c) Genotype & Phenotype.

2.
In pea plants, green seed pods (G) is a dominant trait over yellow seed pods (g)
a) What is the <u>phenotype</u> of a plant, if the genotype is:
i) GG? ii) gg? iii) Gg?

b) What is the <u>genotype</u> of a plant with seed pods that are:

i) green, and it is pure-breeding?

ii) heterozygous?

iii) yellow?

c) Use a punnett square to predict the outcome of each of the following crosses. In each case, state the expected phenotypes of the offspring as a percentage.

i) Gg x Gg **ii) Gg x GG**

iii) gg x GG **iv) Gg x gg**

3.
In rats, black fur (B) is dominant to brown (b).
a) If a pure-breeding black rat mated with a pure-breeding brown rat, what would be the

i) genotypes of the offspring?

ii) phenotypes of the offspring?

b) One of the offspring from the cross described in part (a) was crossed with a brown rat.

i) Use a punnett square to predict the outcome.

ii) In fact, they produced 7 babies; 5 black & 2 brown. Is this result surprising? Explain your answer.

4.
In pea plants, purple flower (P) is dominant to yellow flowers (p).
A pure breeding purple-flower plant was crossed with a pure-breeding yellow-flower plant.
a) Explain why all the offspring will have purple flowers.

b) One of these offspring plants was later crossed with a yellow-flower plant. Showing all working, predict the phenotypes (as ratio or percentage) of the offspring from this second cross.

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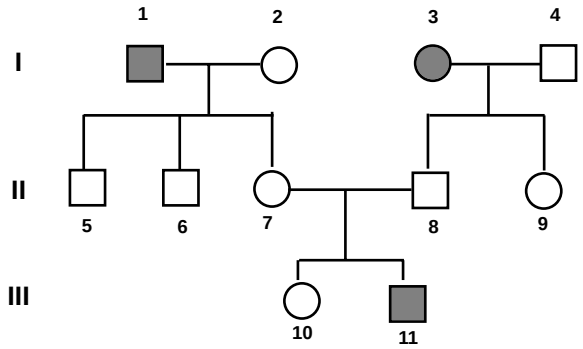
Worksheet 11 Pedigrees

Student Name.....

1. In humans, some people have little fingers that are straight, while others have curved little fingers. This characteristic is inherited by simple Mendelian inheritance. Study the pedigree diagram, then answer the questions which follow.



Shaded shapes represent curved little fingers.

a) Is the curved little fingers trait dominant or recessive? Explain your answer referring to specific individuals above.

b) Assign the letters "S" and "s" appropriately to the 2 alleles operating in this pedigree.

c) Extra information: individuals 2 & 4 are homozygous.

Using the symbols chosen, work out the genotypes of everyone in the pedigree, as far as is possible.

d) Couple 1 & 2 had children who all have straight fingers. Was there any chance they might have had a child with curved little fingers? Explain your answer.

e) Person 5 later married a girl with curved little fingers. Use a punnett square to predict the finger shapes of their children.

f) In fact, person 5 and his wife had 2 beautiful little girls both with straight fingers. Is this possible? Is your prediction wrong?

a) Use the following information to construct a pedigree diagram.

Inheritance of red-hair in the Meggs family.
Fred and Mary both have blonde-brown hair. They have 4 children, a daughter and 3 sons. Their daughter and one son are red-heads, the other 2 sons are similar to their parents. The red-headed son married a red-headed girl and they have a son and a daughter.

b) State whether "red-headedness" is a dominant or recessive trait, giving reason(s).

c) Predict the hair colour of Fred & Mary's grandchildren. Explain your answer.

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Worksheet 12 Sex-Linkage & Intermediate Inheritance

If a Punnett Square is required use back of sheet, or own paper.

Student Name.....

1.
For sex-linked characteristics contolled by 2 alleles with a dominant-recessive relationship:

a) why are there 3 genotypes for females, but only 2 for males?

b) From which parent (mother or father) does a male inherit a sex-linked characteristic? Explain.

c) Using red v. white eyes in fruit flies (as discovered by Morgan)

i) What is the genotype of a female, which is heterozygous?

ii) What is her phenotype?

iii) Explain why this genotype is often referred to as a "carrier" female.

d) Use a Punnett Square to predict the outcome of each cross below. (You must track the X & y chromosomes. Offspring phenotypes should describe the sexes separately)

i) X^ry crossed with X^RX^r

ii) X^Ry crossed with X^rX^r

2.
In humans, a recessive gene ("X^n") carried on the X chromosome causes colour-blindness. The "normal vision" gene can be symbolized by "X^N".
Use these symbols to write the genotype of:
a) a homozygous normal-vision female.

b) a normal-vision male.

c) a colour-blind male.

d) a colour-blind female.

e) a "carrier female" (heterozygous)

f) A man with normal vision married a woman who is colour blind. Use a Punnett Square to predict the pattern of inheritance in their children.

3. In shorthorn cattle, coat colours Red (R) and white (W) are co-dominant alleles. In heterozygotes, the mottled coat is called "roan".

Use Punnett Squares to predict the phenotypes of calves born if:
a) a roan bull mated with a red cow.

b) a white bull mated with a roan cow.

4.
In a particular breed of chickens, the feather colour is controlled by 2 alleles "B" and "W". Genotype BB produces black feathers. Genotype WW produces white feathers. The heterozygous genotype BW results in black & white "speckled" feathers.

Use a Punnett Square to predict the colours of chicks from:

a) a speckled rooster and speckled hen.
b) a black hen and a white rooster.
c) a black rooster and a speckled hen.

d) Is this co-dominance or incomplete dominance? Explain your answer.

5.
Some plants have flower colours controlled as follows: There are only 2 alleles involved, but there are 3 phenotypes possible... red flowers, white flowers and pink flowers.
a) Is this co-dominance or incomplete dominance? Explain.

b) Suggest suitable symbols for the alleles.

c) Use these symbols to write the genotype for:
- **i) red flower**
- **ii) pink flower**
- **iii) white flower**

d) Use a Punnett Square to predict the phenotypes resulting from crossing a red-flowering plant with a white-flowering plant and breeding through to the F_2 in a "Mendel-type" experiment.

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Worksheet 13 Multiple Alleles

Student Name.....

1.
Using appropriate (stated) symbols to represent genes:
a) list the alleles involved in the inheritance of the ABO blood groups in humans. For each gene listed, state the actual (cellular) result of the expression of that gene.

b) List all the possible genotypes possible for these genes, and state the phenotype of each.

2.
Showing full working, predict the probabilities among the children from each pair of parents.
a) Heterozygous type A, and type AB.

b) Type AB and type O.

c) Type O and homozygous type B.

2.
d) Both parents heterozygous type B.

e) Both parents heterozygous Rh+.

3.
For the following information, sketch a pedigree diagram (family tree) and deduce the genotype of each person.

John is blood type AB, married to Jane (type O). Their children are Sally (type B), Zac (type O) and Jake (type A).

One of the children is adopted.
Which one? Explain.

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Worksheet 14 Population Genetics Guided Notes.

(Make your own summary)

Student Name.....

1.
Outline the Hardy-Weinberg Principle, including a list of events which can cause changes in gene frequency.

2.
a) How is gene frequency connected with whether a gene is dominant or recessive? (Careful!)

b) Explain why recessive genes might appear to have a lower frequency than they actually have.

3.
a) What was the goal of the HGP?

b) Why was the project finished faster than expected?

4. Outline 3 important (and interesting) key findings of the HGP.

5.
a) What does SNiP stand for?

b) What does this mean?

c) How can a SNiP be detected?

d) Does a SNiP always cause a change in a protein or polypeptide chain? Explain.

e) What is a possible application of SNiP technology in human medicine?

6.
Discuss how DNA analysis has complemented the fossil record to give us a better understanding of human evolution.

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Answer Section

Worksheet 1

a) one
b) identical
c) parent
d) clone
e) rapid increase in population/ rapid reproduction
f) genetic variation
g) the environment changes
h) mitosis
i) meiosis
j) gametes
k) different / unique
l) chromosomes
m) fertilisation
n) aquatic
o) external
p) internal
q) pollen
r) wind
s) pollen tube
t) ovary
u) moist
v) less (fewer)

Worksheet 2

1. A 2. C 3. A

4.
Mitosis involves a single cell division which produces 2 daughter cells which:
• are identical to each other.
• are identical to the parent cell.
• have the same number of chromosomes.
Meiosis is a double division which produces 4 cells which:
• are all different genetically to each other.
• are different to the parent cell.
• have only half the number of chromosomes.

5.
a) External fertilisation is when the egg & sperm unite in the outside environment. Internal fertilisation occurs inside the body of the female parent.
b) External fertilisation evolved in the aquatic environment and still works well there. Since the environment is water, the gamete cells cannot dry out, and the sperm cells can swim to find the eggs.

Internal fertilisation evolved to suit the terrestrial environment where gametes could rapidly dry out, and sperm would not be able to swim to the egg. The inside of the female reproductive system is kept moist (simulating the aquatic environment) to keep sperm alive and swimming towards the eggs.

6.
Asexual reproduction is an advantage when conditions suit a rapid increase in numbers, to take advantage of a temporary increase in food supply or other resources. It allows rapid reproduction of many offspring without the expenditure of energy and resources that sexual reproduction requires.

Sexual reproduction produces greater genetic diversity & variations in a population. This can help survival of the species at times when the environment changes.

Worksheet 3

1.
a) sperm
b) testes
c) meiosis
d) scrotum
e) sperm duct
f) semen
g) erectile
h) blood
i) penis
j) semen
k) vagina
l) fertilise

2.
A= backbone E= sperm duct
B= rectum
F= penis/erectile tissue
C= testis
G= urethra
D= bladder
H= scrotum

Worksheet 4

1.
a) meiosis
b) ovaries
c) fallopian tube
d) fertilised
e) sperm
f) zygote
g) mitosis
h) embryo
i) uterus
j) placenta
k) food, oxygen
l) amnion

2.
A= backbone
E= uterus
B= rectum
F bladder
C= ovary
G= urethra
D= fallopian tube
H= vagina
I= cervix

Worksheet 5

a) testosterone
b) deeper
c) facial / body
d) oestrogen
e) breasts
f) child birth
g) pituitary
h) follicle
i) progesterone
j) uterus
k) progesterone
l) ovulation
m) pituitary
n) cervix
o) contractions

Worksheet 6

1.
a)Selective breeding is when humans (eg farmers) select the seeds or parent animals for breeding the next crop or generation.
b) It has been practiced for thousands of years.
c) To improve the yield (or other characteristics) of a food crop or domestic animal, etc.
d) Example: all the huge variety of dog breeds have been produced by selective breeding from (originally) the wolf.
Example: modern wheat plants are completely different to the original ancestral grass plant, with far higher yield of seeds, stronger stem, disease resistance, etc.

2.
a) A clone is a group of plants or animals which are genetically identical to each other.
b) By growing a plant from a cutting.

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Answer Section

Worksheet 6 (cont.)

2. (cont.)
c) The first successully cloned mammal. (Research question: decorum prevents us from commenting!)
3.
Tissue culture is a method of cloning plants from a very small sample of cells from the parent plant. These are cultured in a laboratory under highly controlled conditions until each new plant is developed enough to grow in soil.
4.
• allows production of very large numbers of exact copies of a high quality plant / animal.
• to make many copies of an endangered species at risk of extinction, or to produce disease-free individuals in cases where all the wild population are diseased.
5.
a) All of these genetic manipulations <u>reduce</u> the genetic diversity of the species simply because large numbers of offspring are produced from relatively few parents.

b) The danger is that species extinction becomes more likely if the environment changes. Many of our food crops & animals would not survive "in the wild" without human management.

Worksheet 7

<u>Table 1</u>

a) 1	**b) 2**
c) mitosis	**d) meiosis**
e) yes	**f) no**
g) yes	**h) no**

<u>Table 2</u>

a) 2	**b) 4**
c) same	**d) half**
e) yes	**f) no**
g) yes	**h) no**
i) asexual	**j) sexual**

Worksheet 8

a) nucleus	**b) cell division**
c) homologous	**d) allelic**
e) replicated / duplicated	
f) chromatids	
g) identical	**h) in single file**
i) chromatids	**j) identical**
k) parent	**l) in pairs**
m) homologous	**n) 4**
o) half	**p) diploid**
q) haploid	**r) 46**
s) 23	**t) DNA and protein**
u) gene	
v) DNA	**w) polymer**
x) nucleotides	
y) sugar, phosphate & base	
z) A,C,G & T	**aa) helix**
ab) 2	**ac) A-T and C-G**

Worksheet 9

a) communication	**b) collaboration**
c) Wilkins	**d) Franklin**
e) Watson	**f) Crick**
g) base	**h) double**
i) replicated	**j) division**
k) unzip / untwist	**l) template**
m) A & T	**n) C & G**
o) identical	**p) amino acids**
q) polypeptide	**r) 3-D shape**
s) sequence	**t) 20**
u) repel	**v) enzymes**
w) structural	**x) shape**
y) amino	**z) DNA**
aa) 3	**ab) codon**
ac) Transcription	**ad) m-RNA**
ae) template	**af) single**
ag) sugar	**ah) base**
ai) nucleus	**aj) mitochondria**
ak) synthesis	**al) Translation**
am) polypeptide	**an) t-RNA**
ao) mitochondria	**ap) protein**
aq) catalyses	**ar) pigment**

Worksheet 10

1.
a) Dominant gene will always be expressed. Recessive gene can only be expressed when no other allele is present (i.e. if homozygous for the recessive gene)

b) Homozygous means having 2 copies of the same allele for a particular trait. eg, AA, or bb. Heterozygous means to have 2 different alleles for the trait. eg, Aa

c) Genotype is the description (usually in symbols) of the actual genes present for a trait. eg "Aa". Phenotype is the outward appearance caused by the genes for that trait. eg "Purple flowers" or "Dwarf stem".

2.
a) i) green ii) yellow iii) green
b) i) GG ii) Gg iii) gg
c)
i)

Gg x Gg

G & g gametes **G & g**

	G	**g**
G	**GG**	**Gg**
g	**Gg**	**gg**

Phenotypes of Offspring
Green : Yellow
3 : 1
75% : 25%

Answers only for the rest of these.
ii) Gg x GG: 100% green
iii) gg x GG 100% green
iv) Gg x gg 50% green : 50% yellow

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Answer Section

Worksheet 10 (cont.)

3.

a) i) BB x bb: all offspring will have genotype Bb

ii) Phenotype: all will be black

b) i) **Bb x bb**

B & b gametes **b & b**

	b	b
B	Bb	Bb
b	bb	bb

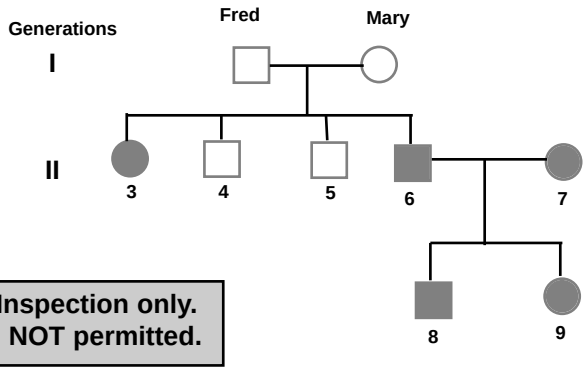
Phenotypes of Offspring
Black : Albino
50% : 50%

ii)Not surprising.
In such small samples, random chance can give results not exactly in the expected ratio.

f) It is quite possible. Prediction is not wrong. In small samples, random chance can result in offspring ratios that are not in agreement with the prediction. (In a large sample of offspring there should be approximately 50-50)

2.

a)Shaded shapes are red-heads



b) Red-headedness must be recessive, because Fred & Mary are not red-heads, but had red-headed children. They must both carry a recessive gene.

c) Must both be red-heads, since their parents are. Since it's recessive, both 6 & 7 must be homozygous for red-hair and must pass on genes to children 8 & 9, who also must be homozygous.

4.

a) Each of the offspring will receive a gene from each parent and so all will have genotype "Pp". Since P is dominant, it will be expressed so all offspring will have purple flowers.

b) **P*p* x *pp***

P & *p* gametes ***p* & *p***

	p	*p*
P	P*p*	P*p*
p	*pp*	*pp*

Phenotypes of Offspring
Purple : Yellow
1 : 1
50% : 50%

Worksheet 11

1.

a) Recessive. Couple 7 & 8 have straight fingers, but had a child (11) with curved little fingers. This can only happen if both parents are carrying a "hidden" gene... therefore it must be recessive.

b) S = Straight, s = curved.

c) 1=ss, 2=SS, 3=ss, 4=SS, 5=Ss, 6=Ss, 7=Ss, 8=Ss, 9=Ss, 10=SS or Ss(uncertain), 11=ss

d) No chance of curved-finger children, because all children must receive a "S" gene from mother who is "SS".

e) Ss x ss would give 50% curved, 50% straight.

Worksheet 12

1.

a) Males cannot be heterozygous because they only have one X chromosome. The y chromosome doesn't carry an allele.

b) From his mother, who gives him his X chromosome. Father gives y, which doesn't carry an allele.

c) i) X^RX^r **ii) Red-eyed**

iii) She carries the recessive gene and passes it to her children, but does not show the phenotype of it herself.

d) i) **X^ry x X^RX^r**

X^r & y gametes **X^R & X^r**

	X^R	X^r
X^r	X^RX^r	X^rX^r
y	X^Ry	X^ry

Phenotypes of Offspring

FEMALES	MALES
Red:White	Red : White
50% : 50%	50% : 50%

ii) Females 100% Red-eyed.
Males 100% white eyed.

keep it simple science

Answer Section

Worksheet 12 (cont.)

2. a) X^NX^N b) X^Ny c) X^ny
d) X^nX^n e) X^NX^n

f) X^Ny x X^nX^n

X^N & y gametes X^n & X^n

	X^n	X^n
X^N	X^NX^n	X^NX^n
y	X^ny	X^ny

Phenotypes of Offspring
FEMALES 100% normal vision
MALES 100% colour blind

3. a) RW x RR

R & W gametes R & R

	R	R
R	RR	RR
W	RW	RW

Phenotypes of Offspring
Red : Roan
1 : 1
50% : 50%

b) WW x RW. Phenotypes of offspring 50%White, 50% Roan.

4. BW x BW
a)

B & W gametes B & W

	B	W
B	BB	BW
W	BW	WW

Phenotypes of Offspring
Black : Speckled : White
1 : 2 : 1
25% : 50% : 25%

b) BB x WW gives 100% Speckled offspring.

c) BB x BW gives 50% Black and 50% Speckled.

d) This is co-dominance, since both black & white colours are separately expressed.

5.
a) Incomplete Dominance, since the characteristics "blend" to form an intermediate colour.

b) Best to use 2 different CAPITALS, R & W.

c) i) RR ii) RW iii) WW

d)
Parents: RR x WW
Gametes: R only W only

F_1: 100% RW (Pink)

F_2 RW x RW

R & W gametes R & W

	R	W
R	RR	RW
W	RW	WW

Phenotypes of Offspring
Red : Pink : White
1 : 2 : 1
25% : 50% : 25%

Worksheet 13

1. a) I^A causes production of antigen "A" on red blood cells.
I^B causes production of antigen "B".
Gene "i" causes no production of any antigen.

b) I^AI^A and I^Ai = blood type A
I^BI^B and I^Bi = blood type B
I^AI^B = blood type AB
ii = blood type O

2.a) parent genotypes I^Ai x I^AI^B
gametes I^A or i x I^A or I^B

	I^A	I^B
I^A	I^AI^A	I^AI^B
i	I^Ai	I^Bi

Possible Children's Phenotypes
Type A 50% chance
Type AB 25%
Type B 25%

b) parent genotypes ii x I^AI^B
gametes i or i x I^A or I^B

	I^A	I^B
i	I^Ai	I^Bi
i	I^Ai	I^Bi

Possible Children's Phenotypes
Type A 50% chance
Type B 50%

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Answer Section

Worksheet 13 (cont.)

2.

c) parent genotypes ii x I^BI^B
gametes i or i x I^B or I^B

Punnett square not needed.
Only one genotype possible I^Bi
Children 100% type B.

d) parent genotypes I^Bi x I^Bi
gametes I^B or i x I^B or i

	I^B	i
I^B	I^BI^B	I^Bi
i	I^Bi	ii

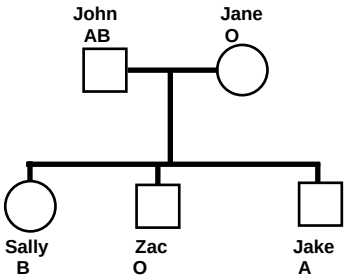
Possible Children's Phenotypes
Type B 75% chance
Type O 25%

a) parent genotypes Dd x Dd
gametes D or d x D or d

	D	d
D	DD	Dd
d	Dd	dd

Possible Children's Phenotypes
Rh + 75%
Rh- 25%

3.
John is I^AI^B **Jane is ii**
Sally is I^Bi
(must receive recessive gene from Jane)
Zac ii
Jake I^Ai (must receive i from Jane)



Zac cannot be John's son because he received "i" from both parents... he must be the adopted child.

Worksheet 14

1.
H-W Principle states that in sexually-reproducing species gene frequencies do NOT change unless:
• natural selection is occurring, or
• migration in/out of study area occurring, or
• "genetic drift" is occurring, or
• matings are not random.
This gives a basis for determining if evolution is occurring or not, by studying gene frequencies within a population. If gene freq. change, but other factors can be accounted for, then evolutionary processes can be inferred.

2.
a) It isn't!
Genes follow the H-W Principle regardless of whether dominant or recessive. This can be proven mathematically.
b) Recessive genes "hide" in the heterozygous types. There may be a lower frequency of phenotypes, but this does not necessarily mean lower gene frequency.

3.
a) To find the sequence of base pairs in all the DNA of the entire human genome.
b) Development of new equipment & techniques for automatic sequencing allowed the pace of discovery to accelerate.

4.
• The human genome contains about 3.3 billion nucleotide base pairs.
• most of this DNA (98%) does not code for genes at all, and much of it cannot yet be explained.
• humans have about 22,000 genes.
(This is much less than previously estimated)

5.
a) single-nucleotide polymorphism.
b) SNiP refers to the occurrence of differences (from one person to another) of a single base-pair in the DNA at a specific location.
c) By DNA sequencing (of specific parts) of each person's genome. It is rare to sequence the entire genome... takes time & is expensive.
d) Not always. There are multiple codons (base triplets) for each ammino acid, so a change in one nucleotide does not always alter the amino acid being coded for.
e) It has been found that the occurrence of specific SNiPs is related to how some diseases develop in a person and how well different treatments work. This opens up possibilities for personalised "targeted" treatments for cancers, etc.

6.
The human genome has been compared to that of apes (chimp, gorilla, etc) and to genomes from extinct human types, such as Neanderthals. This comparison (including distinctive genes as well as SNiPs) has clarified that:
• humans separated genetically from chimps 5-7 Myr BP.
• humans originated in Africa.
• all modern humans are descended from a wave of migration out of Africa about 60,000 yrs ago.
• except for Africans, most of us carry some genes & SNiPs from Neanderthals and/or Denisovan human groups.